

# PATENT ABSTRACTS OF JAPAN

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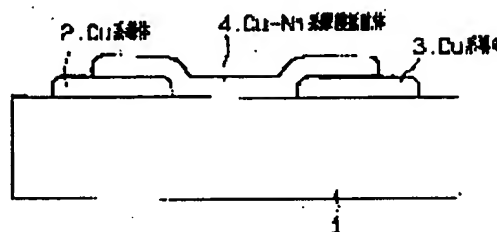
## (54) RESISTOR PASTE, FORMATION METHOD FOR THICK-FILM RESISTOR, AND MANUFACTURE OF THICK-FILM SUBSTRATE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a thick-film resistor of small temperature coefficient resistance (TRC), without using a material which adversely affects the environment such as lead.

**SOLUTION:** On a ceramic substrate 1, where Cu group conductors 2 and 3 are arranged, this resistor paste for which conductive powder constituting of a mixed power (Cu/Ni=60/40 to 80/20) of copper powder and nickel powder, the glass powder of 3-20 pts.wt. to the 100 pts.wt. of the conductive powder and the copper oxide powder of 1-10 pts.wt. are disposed to a vehicle, composed of organic resin and a solvent with the ratio of conductive components of 75-90 wt.% is printed.

Then, it is calcined in a nitrogen atmosphere, and a thick film substrate is manufactured. For the resistor paste, the main component of glass is composed of ZnO or BaO or both and a copper oxide consists of Cu<sub>2</sub>O or CuO or the mixture of Cu<sub>2</sub>O and CuO. The grain diameter of the copper powder is 0.1-2 μm, the grain diameter of the nickel powder is 0.1 μm-2 μm and the grain diameter of the copper oxide is 1 μm-10 μm.



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CLAIMS

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[Claim(s)]

[Claim 1] It has the nozzle means equipped with the nozzle which spouts the dampening water supplied from the source of dampening water. In the dampening water feeder which controls jet and a halt of the dampening water from a nozzle according to the control mode which related with the operation situation of a printing machine and was beforehand defined in order to change the amount of supply of the dampening water supplied with a nozzle means according to the operation situation of a printing machine An active signal output means to output an active signal corresponding to rotation actuation of the rotation section relevant to operation of said printing machine, counting which carries out counting of the signal which an active signal output means outputs, and outputs a signal for every counting of a predetermined number -- with a means The nozzle actuation control means which set up beforehand some control modes set that the amount of supply of dampening water until it results in predetermined operation from printing initiation is different, counting -- with a control mode assignment means to specify alternatively, whenever halt / printing initiation of the operation of a printing machine is carried out in the control mode of a nozzle actuation control means corresponding to accumulation enumerated data based on the signal which a means outputs According to the control mode which the control mode assignment means specified, it is made to perform control with jet and a halt of the dampening water from a nozzle at the time of the printing initiation after \*\*\*\*\* and said halt. The dampening water feeder characterized by supplying the dampening water of the amount usually beyond the initial complement in printing between predetermined from printing initiation.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is a dampening water feeder in the offset press, and relates to the dampening water feeder which can supply the dampening water of the amount which exceeded the initial complement in the usual printing at the time of printing operation initiation especially about the dampening water feeder of a spray type using a jet nozzle.

[0002]

[Description of the Prior Art] Since it can carry out ease [ that the precision of a jet nozzle improved, that there is no contamination in the ink of dampening water, and control of the amount of supply ], and comparatively correctly, the a large number proposal of the dampening water feeder of the spray type in the offset press is made in recent years. Moreover, as shown, for example in JP,52-152309,A, in order to press down generating of the black maculature at the time of printing operation initiation (maculature used as printing which ink adhered to the non-image section and became dirty), it is also known well that there is the need of supplying the dampening water of the amount beyond the initial complement in the usual printing, at the time of printing operation initiation.

[0003] Moreover, it is the dampening water feeder of a spray type, and the dampening water feeder which can moreover supply the dampening water which exceeded the initial complement in the usual printing at the time of printing operation initiation is shown in JP,2-19229,Y.

[0004] The dampening water feeder shown in the official report of this latter forms the electro pneumatic converter which carries out \*\*-sky conversion with the electrical signal from the rate detection means of a rotary press, make the atmospheric pressure in the water tank connected with the jet nozzle correspond to change of the operation rate of a rotary press, it is made to change, and supply of the dampening water corresponding to an operation rate is constituted possible. Furthermore, a current regulator circuit is prepared as one source of the control current which will be accepted to an electro pneumatic converter, and at the time of printing operation initiation, that the pneumatic pressure of the request for supplying a lot of dampening water should be given to a water tank, it is constituted so that \*\*-sky conversion by constant current may be made to perform.

[0005]

[Problem(s) to be Solved by the Invention] By the way, a printing machine may be made to suspend by a certain reason in printing operation. For example, whenever preparing the page constituted from newspaper printing with the report of the contents which may change [ become / the contents of the report / in connection with the passage of time / a detail ], and were doubled with the selling area is generally performed and it finishes printing predetermined number of copies suitably, a printing machine is made to suspend and the corresponding lithographic plate is exchanged. By the latest newspaper printing, the frequency of exchange of the texture top, or the Lycium chinense \*\*\*\*\* and said lithographic plate with a request of a reader became high by offering the newest possible information and the most familiar possible information especially.

[0006] However, at the time of the printing initiation after a halt of this lithographic plate exchange etc.,

by having always supplied dampening water completely like the time of the first printing initiation, it is recognized, and begins and it came to be regarded as questionable that the amount of the black maculature generated at the time of the printing initiation after a halt increases, so that there was much accumulation printing operation before a halt.

[0007] Although the Shinsei cause is not clear, when printing operation increases, retreat of the hydrophilic property of that the temperature of a printing machine, ink, and a lithographic plate becomes high and the non-image section by consumption of a lithographic plate etc. compounds, and it is thought that it is because ink becomes easy to adhere to the non-image section of a lithographic plate.

[0008] This invention aims at mitigating loss by black maculature by this, and raising printing operation effectiveness while making it the black maculature generated at the time of the printing initiation after that halt not increase, even when there are many such problems, i.e., the accumulation printing operation before a halt.

[0009]

[Means for Solving the Problem] This invention is what is going to attain said purpose by the configuration indicated to a claim. That configuration It has the nozzle means equipped with the nozzle which spouts the dampening water supplied from the source of dampening water. In the dampening water feeder which controls jet and a halt of the dampening water from a nozzle according to the control mode which related with the operation situation of a printing machine and was beforehand defined in order to change the amount of supply of the dampening water supplied with a nozzle means according to the operation situation of a printing machine An active signal output means to output an active signal corresponding to rotation actuation of the rotation section relevant to operation of said printing machine, counting which carries out counting of the signal which an active signal output means outputs, and outputs a signal for every counting of a predetermined number -- with a means The nozzle actuation control means which set up beforehand some control modes set that the amount of supply of dampening water until it results in predetermined operation from printing initiation is different, counting -- with a control mode assignment means to specify alternatively, whenever halt / printing initiation of the operation of a printing machine is carried out in the control mode of a nozzle actuation control means corresponding to accumulation enumerated data based on the signal which a means outputs the control voice which the control mode assignment means specified at the time of the printing initiation after \*\*\*\*\* and said halt -- it follows like, and is made to perform control with jet and a halt of the dampening water from a nozzle, and it has become to the configuration which supplied the dampening water of the amount which usually exceeded the initial complement in printing between predetermined from printing initiation.

[0010]

[work --] for the actuation ON signal of a dampening water feeder -- counting -- a means and a nozzle actuation control means will be in an operating state, and dampening water blows off from the nozzle of a nozzle means by actuation control of a nozzle actuation control means by operation initiation of a printing machine.

[0011] and the active signal corresponding to rotation actuation of the rotation section relevant to operation of a printing machine at this time -- an active signal output means -- counting -- it inputs into a means -- having -- this counting -- with a means, a signal is outputted for every counting of a predetermined number. and this counting -- whenever halt / printing initiation of the operation of a printing machine is carried out for the control mode of the above-mentioned nozzle actuation control means with a control mode assignment means corresponding to accumulation enumerated data based on the signal from a means, it is specified alternatively. Thereby, corresponding to some of accumulation printing operation to a halt, it can be made [ many ] a little in the printing initiation after suspending a printing machine rather than the amount which needs the amount of supply of dampening water for the usual printing.

[0012]

[Embodiment of the Invention] The gestalt of implementation of this invention is explained according to a drawing. In the lithography machine possessing the dampening water feeder 1 shown in drawing 1 ,

the image section is made oleophilic. The printing cylinder PC is equipped with the lithographic plate (not shown) formed as a hydrophilic property in the non-image section, and it is ink equipment IN (in drawing 1 R> 1) to this lithographic plate front face. the upstream -- omitting -- being shown -- \*\*\*\* -- while the ink of optimum dose is supplied, the dampening water of optimum dose is supplied by the dampening water feeder 1.

[0013] Consequently, using the opposite physical properties of the image section of said lithographic plate side, and the non-image section, and the physical properties of the dampening water and oil based ink which used water as the principal component repelled mutually, ink is stuck only to the image section and an image is printed through the front face of the blanket (not shown) with which the blanket drum BC was equipped by the web W which it let pass between the blanket drum BC and the impression cylinder IC.

[0014] A roller means 10 to have the contact section with a lithographic plate, a nozzle means 30 to blow off and to supply dampening water towards the predetermined part of this roller means 10 suitably, and a dampening water supply means 50 to supply dampening water to the nozzle means 30 are formed in the dampening water feeder 1.

[0015] The down-stream roller 11 which contacts a lithographic plate and rotates, and the upper roller 12 which receives the dampening water which blows off from the nozzle means 30 while contacting this down-stream roller 11 and rotating contact in parallel mutually, and the roller means 10 is established, and is constituted.

[0016] Although the roller means 10 of illustration consists of two rollers 11, i.e., a down-stream roller, and an upper roller 12 as mentioned above, the configuration that the down-stream roller 11 is omitted and the upper roller 12 contacts a lithographic plate directly is sufficient as it, and the configuration that other rider rollers (not shown) and middle rollers (not shown) were added is sufficient as it.

Furthermore, the configuration performed by the peripheral face of two or more rollers near the contact section of an adjoining roller may be used for the reception of dampening water.

[0017] The tube part material 31 by which the nozzle means 30 was formed in the axis of the upper roller 12, and abbreviation parallel, In two or more examples of (illustration which were attached in abbreviation regular intervals and prepared in this tube part material 31, the nozzle 32 of eight-piece) and 32 -- are provided. The both sides of a longitudinal direction are attached in a frame (not shown) through a bracket 33, and from the dampening water supply means 50 connected so that it might explain later, the tube part material 31 is supplied, where dampening water is pressurized.

[0018] A nozzle 32 and 32 -- have the exhaust nozzle which spouts dampening water to the peripheral face of the upper roller 12, the intake of dampening water carries out opening to the tube part material 31, the exhaust nozzle of dampening water is turned to the peripheral face of the upper roller 12, and they are prepared in the tube part material 31.

[0019] Excitation of the solenoid (not shown) based on control of the below-mentioned nozzle actuation control means 100 opens an exhaust nozzle for a nozzle 32, an exhaust nozzle is closed for it by the force of a spring (not shown) by demagnetization, and the solenoid-valve device (not shown) which controls the amount of supply of the dampening water from a nozzle 32 by closing motion of this exhaust nozzle is prepared in it.

[0020] The dampening water supply means 50 possesses the pump 53 which intervenes all over the duct 52 which connects the dampening water tub 51 and the dampening water tub 51 which store dampening water, and the tube part material 31, and this duct 52, and possesses the pressure regulation means 54 in the downstream of the pump 53 in a duct 52 further. For a duct 52, at least near the bond part with the tube part material 31, it is this better \*\* that is considered as a flexible tubing material so that accommodation and a maintenance of an installation location can be made easy.

[0021] A nozzle actuation control means 100 is electrically coordinated with a speed signal output means 110 output the signal corresponding to the operation rate of a printing machine, and a speed signal output means 110 is coordinated and formed in the rotation section 113 which rotates synchronizing with a printing cylinder PC or this, for example, the main drive shaft in which drive rotation is carried out by the main driving source 112, and consists of pulse signal output devices 111,

such as the rotary encoder which outputs the pulse signal which synchronized with rotation of a printing cylinder PC.

[0022] Having corresponded to the enumerated data of the pulse in predetermined time while outputting an exciting current to a solenoid of a nozzle 32 and 32 --, only the predetermined setup time according to an operation rate can continue the output of an exciting current now, and the nozzle actuation control means 100 specifically possesses CPU and the solenoid driver, whenever it connects so that a pulse signal may be inputted from the pulse signal output device 111, and it carries out counting of the pulse signal and the enumerated data reach the predetermined set point.

[0023] the output voice to which a control mode assignment means 340 to be set up as shown in Table 1 thru/or 3, and to explain later carries out selection assignment of the output mode (namely, nozzles 32 and 32 -- control mode) of the excitation signal for making an exciting current output to the solenoid driver which this nozzle actuation control means 100 does not illustrate -- an excitation signal output [ like ] is carried out. In addition, Table 1 thru/or 3 has illustrated the output mode of the excitation signal in newspaper printing, and the print speed of front Naka shows it by printing number of copies (one usual 2 page width of face of newspapers is called the one section) of the newspaper per hour.

[0024] Table 1 is what illustrated the set point decided as the output mode, i.e., the standard control mode, of an excitation signal for supplying the dampening water of the amount needed in the usual printing, and whenever it carries out 2000 counting of the output pulse of the pulse signal output device 111, it has set up the continuation output time amount of an excitation signal with 70/1000 second thru/or 38/1000 second according to a print speed so that an excitation signal may be outputted.

[0025] Until Table 2 reaches the print speed of the per hour 40,000 section in a predetermined print speed and this example of a display from printing initiation It is what illustrated similarly the set point which determined the output mode of the excitation signal for supplying the dampening water of the amount exceeding the amount needed in the usual printing, i.e., a printing initiation tense mode, as Table 1. Output spacing of an excitation signal is, while carrying out 2000 counting of the output pulse of the pulse signal output device 111, and it is the same as a setup of Table 1. And the output duration of the excitation signal according to a print speed is set as seven kinds corresponding to the accumulation enumerated data of the active signal (the gestalt of implementation of illustration is substituted for the reference pulse signal which the pulse signal output device 111 which explains later outputs) which an active signal output means 300 to have set up for a long time than a setup of Table 1, and to explain later outputs.

[0026] In an active signal, i.e., the gestalt of implementation of illustration, front Naka A and F is the accumulation enumerated data of a reference pulse signal, for example, is the numeric values of 30,000 spacing of 30,000 thru/or 180,000.

[0027] Although it illustrates the set point which determined the output mode (printing initiation tense mode) of the excitation signal for supplying the dampening water of the amount exceeding the amount needed in the usual printing like Table 2 until Table 3 reaches the print speed of the per hour 40,000 section from printing initiation As opposed to making it the output mode of the excitation signal with which Table 2 defined uniformly the number of output pulses of the pulse signal output device 111 for output spacing of an excitation signal, and lengthened output duration of an excitation signal Table 3 The output duration of an excitation signal is defined uniformly and it is different at the point which reduced the number of output pulses of the pulse signal output device 111 which decides output spacing of an excitation signal, namely, is made into the output mode of an excitation signal which reduced output spacing of an excitation signal.

[0028] In addition, in supplying the dampening water of the amount exceeding the amount needed in the usual printing, although not displayed, while lengthening output duration of an excitation signal, you may make it the output mode of an excitation signal which reduced output spacing of an excitation signal.

[0029] moreover, the amendment for 1/1000 second which amends the output duration of an excitation signal so that the nozzle actuation control means 100 may be made as for amendment of the some of the amount of supply of dampening water to every nozzle 32 and 32 -- thru/or 10/1000 second -- counting is

set up and the amendment command from the outside can amend now the output duration of said excitation signal beforehand.

[0030] The active signal output means 300 is constituted so that one signal may be outputted for every rotation of the rotation section corresponding to the rotation actuation of the rotation section which carries out rotation actuation in relation to operation of a printing machine that a signal output should be carried out corresponding to operation of a printing machine. It considers as the pulse output 111 which has the reference pulse output function which outputs a reference pulse signal for said pulse output 111 for every pulse output of a predetermined number, and the gestalt of implementation of illustration is substituted for a reference pulse signal and pulse output 111 as an active signal and an active signal output means 300, respectively. Of course, proper body of revolution (not shown), for example, the active signal output means made to coordinate with a printing cylinder PC, may be prepared separately, without substituting for pulse output 111.

[0031] counting -- whenever a means 320 carries out counting of the active signal which the active signal output means 300 outputs and counting of a predetermined number is completed -- counting -- a terminate signal being outputted and with the gestalt of operation shown by drawing 2 whenever [ which carries out counting of said active signal, and counting of a predetermined number ends ] -- counting -- with the counter 321 which outputs a terminate signal It has DIP switch 322 which sets up the predetermined number which should be carried out counting to a counter 321, and the standup and the differential circuit 323 which corresponds for falling and outputs a differential signal of a dampening water feeder actuation ON-OFF signal.

[0032] the control mode assignment means 340 -- counting -- counting which the counter 321 of a means 320 outputs -- with the output signal of the shift register 341 who shifts a sequential output whenever a terminate signal is inputted, and a shift register 341 AND circuit 342 of plurality (the gestalt of implementation of illustration seven pieces) thru/or 348 prepared for every printing initiation corresponding to the combination of the printing start signal of a printing machine so that any one piece might carry out a signal output, It has the differential circuit 349 which outputs a differential signal corresponding to the standup of each printing start signal.

[0033] Next, actuation of this dampening water feeder 1 is explained. The dampening water currently stored by the dampening water tub 51 with the dampening water feeder actuation ON signal is supplied to the tube part material 31 through a duct 52 with a pump 53. moreover, a dampening water feeder actuation ON signal -- counting -- it is inputted into a means 320 and the nozzle actuation control means 100, and these two means are made into an operating state.

[0034] By actuation control of the nozzle actuation control means 100 explained later, the dampening water supplied to the tube part material 31 is suitably spouted from a nozzle 32 and 32 -- towards the predetermined part of the peripheral face of the upper roller 12 of a roller means 10 to have the contact section with a lithographic plate, only when [ of a nozzle 32 and 32 -- ] a solenoid-valve device is in an open condition. And the dampening water of the remainder of falling from the peripheral face of the upper roller 12 is discharged from the exhaust port which was suitably prepared in the covering 81 grade and which is not illustrated, and is returned to the dampening water tub 51.

[0035] On the other hand, a printing start signal is outputted apart from a dampening water feeder ON signal. Then, with the gestalt of implementation of illustration, while the main driving source 112 carries out rotation actuation, and drive rotation of the printing cylinder PC is carried out by this through a main drive shaft 113 and the pulse signal output device 111 outputs the pulse signal per [ 250 ] rotation of a main drive shaft 113 corresponding to rotation of a main drive shaft 113, whenever it outputs the pulse signal of a predetermined number (for example, 1000), one reference pulse signal is outputted.

[0036] The pulse signal which the pulse signal output device 111 outputs is inputted into the nozzle actuation control means 100. moreover, the reference pulse signal which the pulse signal output device 111 outputs -- said -- it carried out -- as -- as the substitution signal of an active signal -- counting -- it is inputted into a means 320.

[0037] Moreover, if said printing start signal is outputted, this printing start signal will be changed and outputted to a differential signal by the differential circuit 349 of the control mode assignment means



340, and this differential signal will be inputted into AND circuit 342 thru/or 348. AND circuit 342 thru/or 348 support a shift register's 341 signal output situation, and a gap or one output a control mode assignment signal, and it specifies a proper thing alternatively out of the output mode of some control modes 32, i.e., a nozzle, set as the nozzle actuation control means 100, and the excitation signal concerning actuation of 32 --.

[0038] Namely, if the printing signal of the \*\* point is outputted, each signal output terminal of a shift register 341 will not yet carry out a signal output. AND circuit 342 connected with each [ these ] signal output terminal through NOR circuit 350 outputs a control mode assignment signal, and when the control mode shown in Table 1 and 2 is set as the nozzle actuation control means 100, the control mode of Table 1 and the control mode of the control mode number 01 of Table 2 are specified. In addition, the control mode shown in Table 1 is a standard control mode as aforementioned, and is surely specified also by the control mode assignment signal which AND circuit 342 thru/or any of 348 output.

[0039] In such a condition, if the pulse signal which pulse output 111 outputs is inputted into the nozzle actuation control means 100, whenever counting of the pulse signal will be carried out and the enumerated data will reach the predetermined set point, "2000", in the nozzle actuation control means 100 (i.e., whenever a printing cylinder rotates only a predetermined angle of rotation), the excitation signal over a solenoid driver continues only the predetermined setup time, i.e., the setup time corresponding to the print speed at the time, and is outputted. [ for example, ] And the printing initiation tense mode which gives priority to over the standard control mode shown in Table 1 only within the bottom of the condition of the print speed of per hour 40,000 or less section at the time of the printing initiation in this nozzle actuation control means 100 and which is shown in Table 2 is carried out.

[0040] In addition, when the amendment command is beforehand made so that the output mode of these excitation signal may change conditions into every nozzle 32 and 32 -- suitably by the ratio of the streak on a lithographic plate, or arrangement and may supply dampening water, the output of an excitation signal is performed by the amended output duration.

[0041] When an excitation signal is outputted, a solenoid driver follows the excitation signal and is nozzles 32 and 32. -- An exciting current is impressed to the solenoid of a solenoid-valve device, and a valve is opened. Consequently, jet supply of the dampening water of the amount of supply according to the conditions suitably set up beforehand to the predetermined part of the peripheral face of the upper roller 12 is performed.

[0042] That is, when a printing start signal is outputted, a printing machine works and the sequential control of the nozzle 32 by the nozzle actuation control means 100 and 32 -- started with a printing start signal while specifying a control mode accelerates the control mode assignment means 340. Then, only the setup time corresponding to the print speed at the time whenever the "2000" outputs of the pulse signal which the pulse signal output device 111 outputs are carried out is nozzles 32 and 32. -- Opening is carried out, and dampening water blows off and is supplied. He is trying to become the amount of supply in which opening was carried out for a long time a little rather than the standard control mode, and the amount of supply of dampening water exceeded the initial complement in the usual printing of a nozzle 32 and 32 -- until it reached the print speed of the per hour 40,000 section from printing initiation in supply of this dampening water. And printing is usually performed until printing stops with a certain stop signal, and a standard control mode performs opening and he is trying for the amount of supply of dampening water to turn into an initial complement in the usual printing of a nozzle 32 and 32 -- after that in the meantime.

[0043] In addition, they are the nozzles 32 and 32 when it changes to the control mode of Table 2 and the control mode of Table 3 is set as the nozzle actuation control means 100, until it reaches the print speed of the per hour 40,000 section from printing initiation. -- Opening actuation is performed by the control mode of Table 3.

[0044] The dampening water of a nozzle 32 and 32 -- supplied to the upper roller 12 by opening is transferred by the down-stream roller 11, and is supplied to a lithographic plate by rotation actuation of the roller means 10 through the down-stream roller 11 while it is leveled, when passing the contact section of the upper roller 12 and the down-stream roller 11.



[0045] Ink is independently supplied by ink equipment IN at a lithographic plate, by the mutual resilience with the dampening water transferred to the non-image section which is a hydrophilic property, ink is transferred only to the image section which is oleophilic, and the ink of the streak section is printed by Web W through the blanket side of the blanket drum BC.

[0046] moreover, counting made into the operating state by the dampening water feeder ON signal as aforementioned -- with a means 320, a predetermined number value, "30000", is first set as a counter 321 by DIP switch 322. [ for example, ] Furthermore, said dampening water feeder ON signal is changed and outputted to a differential signal by the differential circuit 323. This differential signal is inputted into a counter 321 through OR circuit 324, and resets the enumerated data of a counter 321.

[0047] Moreover, this differential signal resets the shift register 341 of the control mode assignment means 340 who explains later.

[0048] If a printing start signal (printing start signal of the \*\* point) is outputted in such the condition, the control mode by which the control mode assignment means 340 is set as mentioned above as the nozzle actuation control means 100 will be specified, and the main driving source 112 will carry out rotation actuation, and a printing machine will start printing operation. In connection with this, the pulse signal output device 111 outputs the reference pulse signal which is a substitution signal of an active signal, as described above.

[0049] This reference pulse signal is inputted into said counter 321, and a counter 321 carries out counting of this. whenever a counter 321 reaches the set point to which these enumerated data were set by said DIP switch 322 -- the set point -- counting -- a terminate signal is outputted.

[0050] this set point -- counting -- a terminate signal resets the enumerated data of a counter 321 through said OR circuit 324 while being inputted into the shift register 341 of the control mode assignment means 340. a counter 321 -- counting of said reference pulse signal, and the set point -- counting -- the output of a terminate signal is repeated successively.

[0051] the set point to which said counter 321 outputted the shift register 341 -- counting -- if a terminate signal is inputted, one of the output terminals will carry out a signal output. and the set point from a counter 321 -- counting -- the output terminal which carries out the signal output of the output terminal with the gestalt of implementation of illustration one by one at the order of an output terminal a thru/or an output terminal f whenever the sequential input of the terminate signal is carried out is moved.

[0052] The output signal which a shift register 341 outputs is inputted into AND circuit 343 which each output terminals a and f made correspond separately, respectively, and was formed thru/or either of 348.

[0053] Here for example, when only 65,000 is outputted, a reference pulse signal (namely, active signal) A terminate signal is outputted twice. 2 times which is the numeric value by which the counter 321 was set with said tip switch 322 in the reference pulse signal (namely, active signal) to from printing initiation before a halt when printing operation is stopped for lithographic plate exchange every 30,000 - - counting -- carrying out -- the set point -- counting -- And a counter 321 maintains the condition of having carried out 5000 counting of the reference pulse signal (namely, active signal).

[0054] moreover, the shift register 341 -- the set point -- counting -- the terminate signal is inputted twice and the condition that the output terminal b is carrying out the signal output to AND circuit 344 is maintained.

[0055] Under this condition, if the printing start signal for resuming printing is outputted after completing exchange of a lithographic plate, this printing start signal will be changed and outputted to a differential signal in the differential circuit 349 of the control mode assignment means 340, and will be inputted into AND circuit 342 thru/or each of 348. Then, AND circuit 344 with which a shift register's 341 output signal and AND conditions are satisfied outputs a control mode assignment signal, and the printing initiation tense mode shown in the control mode number 03 of a standard control mode and Table 2 shown in Table 1 is specified.

[0056] Moreover, a printing machine works and the sequential control started with the printing start signal for resuming said printing accelerates it. And it is changed into the control mode only the control mode of dampening water supply is indicated to be to the control mode number 03 of Table 2 until a

printing machine reaches the print speed of the per hour 40,000 section from printing initiation like the above, and printing operation is carried out.

[0057] Henceforth, printing is suspended by the stop signal, like [ whenever the printing start signal for resuming printing after that is outputted ] the above, by the control mode assignment means 340, selection assignment of the proper control mode of dampening water supply is carried out, and printing operation of a printing machine is performed. And a dampening water feeder suspends all actuation with the dampening water feeder actuation OFF signal outputted after printing of number of copies of a schedule is completed.

[0058] In addition, what is necessary is just to let the printing initiation tense mode of the dampening water supply set as the nozzle actuation control means 100 be a control mode including the dampening water supply for counter etching, in carrying out counter etching of a lithographic plate at the time of printing operation initiation.

[0059] Moreover, a setup of the accumulation enumerated data of the reference pulse signal (namely, active signal) used as the criteria when specifying a control mode may be suitably defined according to the actual condition.

[0060] furthermore, counting -- you may be the configuration of making all or a part of operations equivalent to a means 320 and the control mode assignment means 340 perform to CPU which is a part of nozzle actuation control means 100, or CPU prepared independently.

[0061]

[Effect of the Invention] Are as a publication above and the lithographic plate exchange in newspaper printing etc. corresponds to some of accumulation printing operation to a halt in the printing initiation after suspending a printing machine by carrying out this invention. Since it considers as many [ a little ] amount of supply and adhesion of the ink to the non-image section of a lithographic plate was lost for a short time rather than the amount which needs the amount of supply of dampening water for the usual printing, the descendant of black maculature could be reduced compared with the former. Therefore, while loss of the large sum by black maculature is mitigable, the operation effectiveness of a printing machine can be raised.

[0062]

[Table 1]  
(標準制御態様)

出力間隔	パルス信号2000カウント毎								
印刷速度 (万部/時)	< 2	< 4	< 6	< 8	< 10	< 12	< 14	< 16	16 ≤
出力継続時間 (秒)	0.070	0.066	0.062	0.058	0.054	0.050	0.046	0.042	0.038

[0063]

[Table 2]

(印刷開始時制御態様)

制 御 態 様 番 号	出力間隔		パルス信号 2000 カウント毎	
	印刷速度 (万部/時)	作動信号 累積計数値	< 2	< 4
01	< A	出 力 継 続 時 間 ( 秒 )	0.075	0.071
02	< B		0.080	0.076
03	< C		0.085	0.081
04	< D		0.088	0.084
05	< E		0.091	0.087
06	< F		0.094	0.090
07	F ≤		0.096	0.092

[0064]

[Table 3]

(印刷開始時制御態様)

制 御 態 様 番 号	出力継続時間 (S)		0.070	0.066
	印刷速度 (万部/時)		< 2	< 4
	作動信号 累積計数値			
01'	< A	出 力 間 隔 ( パ ル ス 信 号 カ ウ ン ト 数 )	1 9 2 0	
02'	< B		1 8 6 0	
03'	< C		1 8 0 0	
04'	< D		1 7 4 0	
05'	< E		1 7 0 0	
06'	< F		1 6 6 0	
07'	F ≤		1 6 4 0	

[Translation done.]

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the outline configuration explanation perspective view of the lithography machine equipped with the gestalt of 1 operation of the dampening water equipment of this invention.

[Drawing 2] It is the block diagram showing the gestalt of 1 implementation of the configuration for control mode assignment of the dampening water equipment of this invention.

[Description of Notations]

1 [ -- An upper roller, ] -- A dampening water feeder, 10 -- A roller means, 11 -- A down-stream roller, 12 30 [ -- Bracket, ] -- A nozzle means, 31 -- Tube part material, 32 -- A nozzle, 33 50 [ -- Pump, ] -- A dampening water supply means, 51 -- A dampening water tub, 52 -- A duct, 53 54 -- A pressure regulation means, 100 -- A nozzle actuation control means, 110 -- Speed signal output means, 111 -- A pulse signal output device, 112 -- A main driving source, 113 -- Main drive shaft, 300 -- Active signal output means (the gestalt of implementation of illustration is substituted for a nozzle actuation control means), 320 -- counting -- a means, a 321 -- counter, and a 322 -- DIP switch -- 323 -- A differential circuit, 324 -- An OR circuit, 340 -- Control mode assignment means, 341 -- A shift register, --342, 343, 344, 345, 346, 347, 348 -- AND circuit, 349 [ -- A printing cylinder, BC / -- A blanket drum, IC / -- An impression cylinder, IN / -- Ink equipment, W / -- Web. ] -- A differential circuit, 350 -- A NOR circuit, a, b, c, d, e, f -- A shift register's output terminal, PC

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[Translation done.]

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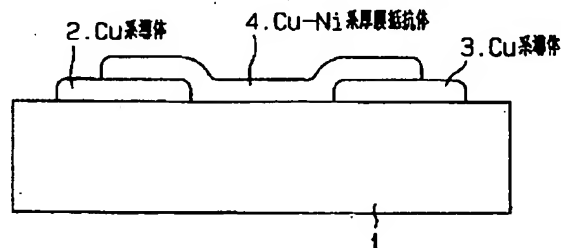
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(54) 【発明の名称】 抵抗体ペースト、厚膜抵抗体の形成方法および厚膜基板の製造方法

(57) 【要約】

【課題】鉛などの環境に対し悪影響を与える物質を使用することなく抗温度係数 (TCR) の小さい厚膜抵抗体を得る。

【解決手段】 Cu系導体 2, 3 を配置したセラミック基板 1 の上に、銅粉とニッケル粉の混合粉 (Cu/Ni = 60/40 ~ 80/20) からなる導電性粉末と、該導電性粉末 100 重量部に対し 3 ~ 20 重量部のガラス粉末および 1 ~ 10 重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が 75 ~ 90 重量% で分散した抵抗体ペーストを印刷する。そして、窒素雰囲気下で焼成して厚膜基板を製造する。抵抗体ペーストはガラスの主成分が ZnO や BaO またはその両方からなり、銅酸化物が Cu<sub>2</sub>O または CuO、あるいは Cu<sub>2</sub>O と CuO の混合物からなる。銅粉の粒径が 0.1 μm ~ 2 μm、ニッケル粉の粒径が 0.1 μm ~ 2 μm、銅酸化物の粒径が 1 μm ~ 10 μm である。



## 【特許請求の範囲】

【請求項1】 銅粉とニッケル粉の混合粉またはCu-Ni合金粉からなる導電性粉末と、該導電性粉末100重量部に対し3～20重量部のガラス粉末および1～10重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が75～90重量%で分散したことを特徴とする窒素雰囲気焼成用抵抗体ベースト。

【請求項2】 銅とニッケルの混合比がCu/Ni=60/40～80/20である請求項1記載の抵抗体ベースト。

【請求項3】 ガラスの主成分がZnOまたはBaO、あるいはZnOとBaOからなり、銅酸化物がCu<sub>2</sub>OまたはCuO、あるいはCu<sub>2</sub>OとCuOの混合物からなる請求項1記載の抵抗体ベースト。

【請求項4】 銅粉の粒径が0.1μm～2μm、ニッケル粉の粒径が0.1μm～2μm、Cu-Ni合金粉の粒径が0.1μm～2μm、銅酸化物の粒径が1μm～10μmである請求項1記載の抵抗体ベースト。

【請求項5】 銅粉とニッケル粉の混合粉またはCu-Ni合金粉からなる導電性粉末と、該導電性粉末100重量部に対し3～20重量部のガラス粉末および1～10重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が75～90重量%で分散して抵抗体ベーストとし、

このベーストを窒素雰囲気下で焼成して厚膜抵抗体を形成したことを特徴とする厚膜抵抗体の形成方法。

【請求項6】 銅とニッケルの混合比がCu/Ni=60/40～80/20である請求項5記載の厚膜抵抗体の形成方法。

【請求項7】 ガラスの主成分がZnOまたはBaO、あるいはZnOとBaOからなり、銅酸化物がCu<sub>2</sub>OまたはCuO、あるいはCu<sub>2</sub>OとCuOの混合物からなる請求項5記載の厚膜抵抗体の形成方法。

【請求項8】 銅粉の粒径が0.1μm～2μm、ニッケル粉の粒径が0.1μm～2μm、Cu-Ni合金粉の粒径が0.1μm～2μm、銅酸化物の粒径が1μm～10μmである請求項5記載の厚膜抵抗体の形成方法。

【請求項9】 電極材であるCu系導体を配置した基板の上に、

銅粉とニッケル粉の混合粉またはCu-Ni合金粉からなる導電性粉末と、該導電性粉末100重量部に対し3～20重量部のガラス粉末および1～10重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が75～90重量%で分散した抵抗体ベーストを印刷する工程と、窒素雰囲気下で焼成する工程と、を備えたことを特徴とする厚膜基板の製造方法。

【請求項10】 銅とニッケルの混合比がCu/Ni=

60/40～80/20である請求項9記載の厚膜基板の製造方法。

【請求項11】 ガラスの主成分がZnOまたはBaO、あるいはZnOとBaOからなり、銅酸化物がCu<sub>2</sub>OまたはCuO、あるいはCu<sub>2</sub>OとCuOの混合物からなる請求項9記載の厚膜基板の製造方法。

【請求項12】 銅粉の粒径が0.1μm～2μm、ニッケル粉の粒径が0.1μm～2μm、Cu-Ni合金粉の粒径が0.1μm～2μm、銅酸化物の粒径が1μm～10μmである請求項9記載の厚膜基板の製造方法。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、抵抗体ベースト、厚膜抵抗体の形成方法および厚膜基板の製造方法に関するものである。

【0002】

【従来の技術】厚膜抵抗体を有する厚膜基板の製造方法を図2を用いて説明する。まず、セラミック基板11の上にAg、Pd、ガラスフリットからなる貴金属ベーストをスクリーン印刷し、空気中で焼成して導体（電極）12、13を形成する。そして、その上に、RuO<sub>2</sub>またはAg-Pdと酸化鉛系ガラスからなる抵抗体ベーストを印刷し、空気中で焼成して厚膜抵抗体14を形成している。

【0003】ここで、貴金属ベーストは高価であり、また、ハイブリッドICの回路に使用すると、はんだ食われによる部品接合部の信頼性低下、Ag（銀）のエレクトロマイグレーションが懸念される。この対策として、Ag電極の代わりにCu電極が使用される。

【0004】

【発明が解決しようとする課題】しかし、Cu電極を使用した場合には酸化を防止するために窒素雰囲気下で焼成することとなり、抵抗体に従来の酸化ルテニウムまたはAg-Pdを使用すると、窒素雰囲気下で還元を受け、希望の抵抗値、抵抗温度係数（TCR）が得られにくい。

【0005】また、近年環境への対応が求められており、Pb、Cdなどの有害物質は、使用しない方向に進んでいる。そこで、この発明の目的は、鉛などの環境に対し悪影響を与える物質を使用することなく抵抗温度係数（TCR）の小さい厚膜抵抗体を得ることにある。

【0006】

【課題を解決するための手段】請求項1に記載の窒素雰囲気焼成用抵抗体ベーストは、銅粉とニッケル粉の混合粉またはCu-Ni合金粉からなる導電性粉末と、該導電性粉末100重量部に対し3～20重量部のガラス粉末および1～10重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が75～90重量%で分散したことを特徴としている。



【0007】よって、請求項5に記載のごとく、厚膜抵抗体の形成方法として、銅粉とニッケル粉の混合粉またはCu-Ni合金粉からなる導電性粉末と、該導電性粉末100重量部に対し3~20重量部のガラス粉末および1~10重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が75~90重量%で分散して抵抗体ペーストとし、このペーストが窒素雰囲気下で焼成されて厚膜抵抗体が形成される。

【0008】また、請求項9に記載のごとく、厚膜基板の製造方法として、電極材であるCu系導体を配置した10 基板の上に、銅粉とニッケル粉の混合粉またはCu-Ni合金粉からなる導電性粉末と、該導電性粉末100重量部に対し3~20重量部のガラス粉末および1~10重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が75~90重量%で分散した抵抗体ペーストが印刷される。その後、窒素雰囲気下で焼成される。

【0009】このようにして、Cu-Ni系厚膜抵抗体として、鉛などの環境に対し悪影響を与える物質を使用することなく、抵抗温度係数の小さい厚膜抵抗体を形成20 できる。

【0010】ここで、請求項2, 6, 10に記載のように、銅とニッケルの混合比をCu/Ni=60/40~80/20とすると、抵抗温度係数をより小さくできる。よって、温度環境の厳しい車載用とする場合に好適なものとなる。

【0011】また、請求項3, 7, 11に記載のように、抵抗体ペーストは、ガラスの主成分がZnOまたはBaO、あるいはZnOとBaOからなり、銅酸化物がCu<sub>2</sub>OまたはCuO、あるいはCu<sub>2</sub>OとCuOの混30 合物からなるものとする、より好ましいものとなる。

【0012】また、請求項4, 8, 12に記載のように、抵抗体ペーストは、銅粉の粒径が0.1μm~2μm、ニッケル粉の粒径が0.1μm~2μm、Cu-Ni合金粉の粒径が0.1μm~2μm、銅酸化物の粒径が1μm~10μmであるものとする、より好ましいものとなる。

【0013】

【発明の実施の形態】以下、この発明を具体化した実施の形態を図面に従って説明する。図1に、本実施形態における厚膜基板を示す。本例では車載用として使用されるものであり、厚膜抵抗体4の仕様として、抵抗温度係数(TCR)が-55℃~125℃の範囲で200ppm/℃以下を満足している。

【0014】図1に示すように、アルミナ製のセラミック基板1の上には、電極材としてのCu系導体2が形成されるとともに、Cu系導体2とは離れた位置に電極材としてのCu系導体3が形成されている。また、セラミック基板1の上には、Cu-Ni系厚膜抵抗体4が形成され、Cu系導体(電極)2とCu系導体(電極)340

との間にCu-Ni系厚膜抵抗体4が配置された構造となっている。

【0015】次に、この厚膜基板の製造方法を説明する。まず、上記Cu-Ni系厚膜抵抗体4を形成するためのCu-Ni系厚膜抵抗体ペーストを用意する。この抵抗体ペーストは、銅粉とニッケル粉の混合粉からなり、かつ、銅とニッケルの混合比がCu/Ni=60/40~80/20である導電性粉末と、該導電性粉末100重量部に対し3~20重量部のガラス粉末および1~10重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が75~90重量%で分散したものである。

【0016】銅粉の粒径は0.1μm~2μmであり、ニッケル粉の粒径は0.1μm~2μmであり、スクリーン印刷を行う上で好ましい範囲としている。ニッケル粉の粒径として、より好ましいのは、0.5μm~1μmの範囲である。銅粉は、硫酸銅、塩化銅の還元剤による還元銅粉、アトマイズ銅粉を分級したものが使用できる。ニッケル粉は、硫酸ニッケル、塩化ニッケルの還元ニッケル、アトマイズニッケル、カルボニッケルからの分解ニッケル、これらを溶融再結晶化した金属粉が使用できる。

【0017】ここで、Cu粉とNi粉の混合比率を変えることにより、抵抗値および抵抗温度係数(TCR)を変化させることができ、目標とする抵抗値およびTCRになるようにこの比率を適宜選択している。つまり、Cu/Ni重量比を60/40~80/20とすることにより、-55℃~125℃の範囲でTCRが200ppm/℃以下になる。

【0018】なお、銅粉とニッケル粉の混合粉にて導電性粉末を構成したが、Cu-Ni合金粉にて導電性粉末を構成してもよい。この場合、Cu-Ni合金粉の粒径は0.1μm~2μmとするとよい。

【0019】また、ガラス粉末は、厚膜抵抗体4をセラミック基板1に接着するためと抵抗値の調整のために必要であるが、PbやCdを含まずZnOまたはBaOまたはその両方を主成分としている。ガラスの軟化点は550~650℃、熱膨張率は85~97×10<sup>-7</sup>/℃とするのが望ましい。ここで、ガラスの軟化点は亜鉛とバリウムの割合にて調整することができる。

【0020】より具体的には、ガラスフリットとしては、融点500℃~800℃の硼酸亜鉛、硼酸バリウム、硼珪酸ガラスがよい。さらに、銅酸化物(粉末)はCu<sub>2</sub>OまたはCuO、あるいはCu<sub>2</sub>OとCuOの混合物からなる。銅酸化物の粒径は1μm~10μmであり、スクリーン印刷を行う上で好ましい範囲となっている。

【0021】このように、導電性粉末、ガラス粉末、銅酸化物粉末は、ビヒクルと混練してペースト状組成物とされるが、この組成物は、100~400メッシュの印50

刷スクリーンによって印刷されるので、 $20\mu\text{m}$ 以上の粒子がほとんどない平均粒子径 $1\mu\text{m}$ 程度のものが特に適している。

【0022】ビヒクルに使用される溶剤としては、テルペン系、エステルアルコール、芳香族炭化水素、エステル系溶剤が用いられる。テルペン系溶剤としては、リモネン、パラメンタン、ピナン、ターピネオール、ジヒドロターピネオール等が例示される。エステルアルコールとしては、2,2,4-トリメチル1,3-ペンタジオールが例示される。芳香族炭化水素としては、キシレン、

10 イソプロピルベンゼン、メチルシクロヘキサン、トルエンが例示される。エステル系溶剤としては、酢酸エチレングリコールモノメチルエーテル、酢酸ジエチレングリコールモノメチルエーテル、酢酸ジエチレングリコールモノブチルエーテルが例示される。あるいは、これら溶剤のうちの複数の混合溶剤を用いてもよい。

【0023】ビヒクルに使用される有機樹脂としては、セルロース系樹脂、アクリル系樹脂、アルキッド系樹脂が用いられる。セルロース系樹脂としては、エチルセルロース、ニトロセルロースが挙げられる。アクリル系樹脂

20 としては、メチルアクリレート、エチルアクリレート、プロピルアクリレート、ブチルアクリレート、メチルメタアクリレート、エチルメタアクリレート、プロピルメタアクリレート、ブチルメタアクリレートまたはこれらの複数の混合物、複数のモノマーの共重合体が挙げられる。アルキッド系樹脂としては、多価アルコールに2価のエチレングリコール、プロピレングリコールなど、3価のアルコールとしてグリセリン、トリメチロールプロパンなど、多価アルコールとしてジグリセリン、トリグリセリンなどが使用できる。

【0024】さらに、添加有機剤として、多塩基酸無水フタル酸、琥珀酸、マレイン酸、イタコン酸等が例示される。添加有機剤の一つである変性剤として、大豆油、桐油、脱水ひまし油等の脂肪酸、オレイン酸、ステアリン酸等が挙げられる。また、添加有機剤の一つである天然樹脂として、ロジン、セラック等が挙げられ、合成樹脂として、エステルガム、フェノール樹脂、アクリル樹脂などが挙げられる。

【0025】そして、厚膜基板の製造の際には、まず、図1に示すように、Cu系導体ペーストをセラミック基板1上にスクリーン印刷により塗布する。さらに、焼成して電極材であるCu系導体2,3を得る。

【0026】引き続き、前述したCu-Ni系厚膜抵抗体ペーストをセラミック基板1上にスクリーン印刷により塗布する。そして、窒素雰囲気下で焼成してCu-Ni系厚膜抵抗体4を得る。

【0027】その結果、図1に示す厚膜基板が製造される。以下、厚膜抵抗体ペーストの成分や配合を変えて抵抗値やTCRや接着強度を測定し、評価を行ったので、それを説明していく。

【0028】表1,2,3には、評価結果を示す。サンプルとしては、表1,2,3において縦の項目で表すように、実施例1~20および比較例1~3を用いた。また、この表1,2,3において、横の項目として、抵抗体ペーストの導電成分の割合(Cu-Ni含有率)、CuとNiの組成比率、ガラス主成分、ガラス成分の割合、銅酸化物の割合をとっている。さらに、表1,2,3の横の項目で表すように、測定項目として、面抵抗(単位: $\text{m}\Omega/\square$ )、 $25^\circ\text{C}\sim 150^\circ\text{C}$ でのTCR、 $-55^\circ\text{C}\sim 25^\circ\text{C}$ でのTCR、接着強度(単位: $\text{Kg}/\square$ )をとっている。

【0029】実施例1~20では、導電成分の割合(Cu-Ni含有率)は75~90wt%であり、CuとNiの比率はCu/Ni=60/40~80/20であり、ガラス量は導電性粉末100重量部に対し3~20重量部であり、銅酸化物の量は導電性粉末100重量部に対し1~10重量部である。

【0030】これに対し、比較例1ではガラス量は導電性粉末100重量部に対し1重量部であり、比較例2では、CuとNiの比率はCu/Ni=90/10であり、比較例3では、CuとNiの比率はCu/Ni=50/50である。

【0031】比較例1では接着強度が $0.3\text{Kg}/\square$ と低くなっているが、実施例1~20では、接着強度が $1.5\text{Kg}/\square$ 以上であった。また、比較例2では $25^\circ\text{C}\sim 150^\circ\text{C}$ でのTCRおよび $-55^\circ\text{C}\sim 25^\circ\text{C}$ でのTCRが、共に500ppmと大きい。実施例1~20では、 $25^\circ\text{C}\sim 150^\circ\text{C}$ でのTCRおよび $-55^\circ\text{C}\sim 25^\circ\text{C}$ でのTCRが、共に200ppm以下であった。さらに、比較例3では面抵抗が $60\text{m}\Omega/\square$ と大きい。実施例1~20では、面抵抗が $47\text{m}\Omega/\square$ 以下であった。

【0032】このように、本実施の形態は、下記の特徴を有する。

(イ) 窒素雰囲気焼成用抵抗体ペーストとして、銅粉とニッケル粉の混合粉(またはCu-Ni合金粉)からなる導電性粉末と、該導電性粉末100重量部に対し3~20重量部のガラス粉末および1~10重量部の銅酸化物粉末を、有機樹脂および溶剤からなるビヒクルに、導電成分の割合が75~90重量%で分散したものを用いた。

(ロ) そして、この抵抗体ペーストを窒素雰囲気下で焼成してCu-Ni系厚膜抵抗体4を形成した。

(ハ) 特に、電極材であるCu系導体2,3を配置した基板1の上に、(イ)の抵抗体ペーストを印刷し、その後窒素雰囲気下で焼成して厚膜基板を製造した。

【0033】このようにすると、Cu-Ni系厚膜抵抗体4として、鉛などの環境に対し悪影響を与える物質を使用することなく、抵抗温度係数(TCR)の小さい厚膜抵抗体4を形成できる。

(ニ) 抵抗体ペーストにおける銅とニッケルの混合比を  $\text{Cu}/\text{Ni}=60/40 \sim 80/20$  としたので、抵抗温度係数 (TCR) をより小さくできる。よって、本実施形態のように温度環境の厳しい車載用とする場合に好適なものとなる。

(ホ) 抵抗体ペーストにおけるガラスの主成分が  $\text{ZnO}$  または  $\text{BaO}$ 、あるいは  $\text{ZnO}$  と  $\text{BaO}$  からなり、銅酸化物が  $\text{Cu}$ 、 $\text{O}$  または  $\text{CuO}$ 、あるいは  $\text{Cu}$ 、 $\text{O}$  と  $\text{Cu}$  \*

\*  $\text{O}$  の混合物からなるので、より好ましいものとなる。

(ヘ) 抵抗体ペーストにおける銅粉の粒径が  $0.1 \mu\text{m} \sim 2 \mu\text{m}$ 、ニッケル粉の粒径が  $0.1 \mu\text{m} \sim 2 \mu\text{m}$ 、銅酸化物の粒径が  $1 \mu\text{m} \sim 10 \mu\text{m}$  であるので、より好ましいものとなる。

【0034】

【表1】

実施例	CuNi含有率 (wt%)	CuNi比	ガラス主成分	ガラス量	銅酸化物量	銅粉量 (mg/g)	TCR (25-150℃)	TCR (-55-25℃)	焼成強度 (Kg/g)
1	75	70/30	ZnO	10	10	40	200ppm以下	200ppm以下	2.2
2	80	70/30	ZnO	3	5	35	200ppm以下	200ppm以下	1.5
3	80	70/30	ZnO	7	5	37	200ppm以下	200ppm以下	2
4	80	70/30	ZnO	10	5	40	200ppm以下	200ppm以下	2.2
5	80	60/40	ZnO	10	5	47	200ppm以下	200ppm以下	2.2
6	85	80/20	ZnO	7	3	25	200ppm以下	200ppm以下	2
7	85	70/30	ZnO	3	10	35	200ppm以下	200ppm以下	1.5
8	85	70/30	ZnO	7	3	37	200ppm以下	200ppm以下	2
9	85	70/30	ZnO	7	5	37	200ppm以下	200ppm以下	2
10	85	70/30	ZnO	7	10	37	200ppm以下	200ppm以下	2

【0035】

※ ※ 【表2】

実施例	CuNi含有率 (wt%)	CuNi比	ガラス主成分	ガラス量	銅酸化物量	銅粉量 (mg/g)	TCR (25-150℃)	TCR (-55-25℃)	焼成強度 (Kg/g)
11	85	70/30	ZnO	10	5	40	200ppm以下	200ppm以下	2.2
12	85	70/30	ZnO	20	3	43	200ppm以下	200ppm以下	2.3
13	85	60/40	ZnO	7	3	45	200ppm以下	200ppm以下	2
14	90	70/30	ZnO	3	3	35	200ppm以下	200ppm以下	1.5
15	80	70/30	BaO	3	5	35	200ppm以下	200ppm以下	1.5
16	85	70/30	BaO	7	5	37	200ppm以下	200ppm以下	2
17	85	70/30	BaO	10	5	40	200ppm以下	200ppm以下	2.2
18	80	70/30	ZnO, BaO	3	5	35	200ppm以下	200ppm以下	1.5
19	85	70/30	ZnO, BaO	7	5	37	200ppm以下	200ppm以下	2
20	85	70/30	ZnO, BaO	10	5	40	200ppm以下	200ppm以下	2.2

【0036】

★40★ 【表3】

比較例	CuNi含有率 (wt%)	CuNi比	ガラス主成分	ガラス量	銅酸化物量	銅粉量 (mg/g)	TCR (25-150℃)	TCR (-55-25℃)	焼成強度 (Kg/g)
1	85	70/30	ZnO	1	3	37	200ppm以下	200ppm以下	0.3
2	85	90/10	ZnO	7	3	10	500ppm	500ppm	2
3	85	50/50	ZnO	7	3	60	200ppm以下	200ppm以下	2

【図面の簡単な説明】

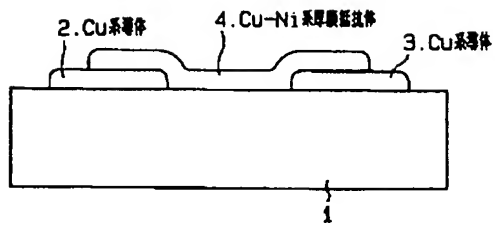
【図1】 実施の形態における厚膜基板の断面図。

【図2】 従来技術を説明するための厚膜基板の断面図。

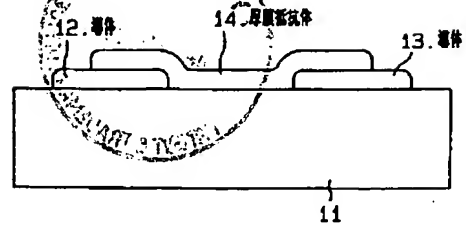
【符号の説明】

1…セラミック基板、2…Cu系導体、3…Cu系導体、4…Cu-Ni系厚膜抵抗体。

【図1】



【図2】



フロントページの続き

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